No No. 54

November, 1960

ONTARIO

FISH AND WILDLIFE MANAGEMENT REPORT

PROVINCE OF ONTARIO
DEPARTMENT OF LANDS AND FORESTS
Fish and Wildlife Branch

(These Reports are for Intra-Departmental Information and Not for Publication)

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Minister

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Deputy Minister

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THE POLAR BEAR IN ONTARIO

by

A. T. Cringan, J.A. Macfie and T. Batchelor
(with additions by D. W. Simkin)

Abstract

The polar bear occurs along Ontario's marine coast bordering on Hudson and James Bays at least south to Attawapiskat, and inland as much as 100 miles. The provincial polar bear population which is estimated at not more than a few hundred is present throughout the year. Polar bears range mostly along the coast during the summer months. The females move inland during November, den up, bear young, then return to the coast during March or April. Parturition occurs regularly in the inland areas adjacent to Hudson Bay, at least from late November until early January. The average kill of polar bears in the Severn and Winisk Management areas is 10 to 15 per year. Factors deemed adverse to the future of the polar bear in Ontario are listed.

The polar bear, Thalarctos maritimus (Phipps), has long been known to occur in Ontario. There was no specimen of Ontario origin preserved in a museum until 1948, when a specimen was collected at Cape Henrietta Maria by L. Waldon, a member of a Royal Ontario Museum field party.

There is little available information on the biology of this species in Ontario. Downing (1948) states that the polar bear is found along the coast of Ontario bordering on Hudson and James Bays, and that the Hudson Bay coast of Ontario is within the area where the female polar bear hibernates and bears her cubs.

Sioux Lookout District Wildlife Management Officers have collected considerable information about the polar bear during the past few years (1950 to 1953). As more is learned about this interesting species, it becomes increasingly apparent that it merits consideration in Ontario's overall management program. This note has been prepared in order to consolidate the data we have on file, and to emphasize the need for polar bear management.

Distribution

The polar bear is regularly found throughout the year along the Hudson Bay coast of Ontario. It also occurs along the James Bay coast, south to within a few miles of the Attawapiskat River, according to W. H. Houston, formerly a Hudson's Bay Company employee.

Several Indians at Severn and Winisk report that polar bears commonly range up to 70-80 miles inland. One report concerns tracks seen during two successive winters in a place 105 miles directly inland. This place is 142 miles from the coast via the Winisk River, the probable route travelled by the bear. Indians have observed bears at comparable distances from the coast in the Severn drainage basin. Large rivers are not the only avenues serving for the long inland wanderings of polar bears. Indians report that bears range inland up to 70-80 miles in the Blackduck River basin, northwest of Severn.

Kill Data

An attempt has been made to enumerate the Ontario polar bear kill during the past three years. The following summarizes the findings:

(Year considered to be from July 1st - June 30th)

1950-51 - Reported combined kill for Severn and Winisk areas about fifteen, about equally divided between the two areas.

1951-52 - Total kill about eight or ten, largely from the Winisk area. One polar bear skull from Severn was donated to the Royal Ontario Museum of Zoology and Palaeontology, as was one from Winisk. A second skull from Winisk was lost to a black bear during preparation.

1952-53 - Total kill up to March 14th at least eleven, consisting of four adults and three cubs, Severn area, and two adults, two cubs in the Winisk area. Carcasses of the two cubs from the Winisk area were donated to the R.O.M.Z.P. The hides of the other nine bears were seen by T. Batchelor during March 1953.

The kill is said to occur principally during December and March. Natives report that practically all of the adult polar bears killed are females, and that these are usually killed in or about exposed dens along the banks of the Severn and Winisk Rivers. Travel by trappers is heavier along these rivers than elsewhere.

Utilization of Polar Bears

Mr. W. H. Houston related that, two decades ago, Indians from Attawapiskat occasionally killed polar bears, although they did not deliberately hunt them. During an interview held at Fort Severn, in March 1953, natives reported that they did not hunt polar bears to get meat for their own consumption, as the meat is too strong, nor for dog food. (Still, the meat is sometimes used incidentally as dog food.) Indeed, some natives claimed to have seen polar bears which they did not even try to kill.

Economic gain seems to be the principal motive behind the killing of polar bears at Severn and Winisk. In the spring of 1951, the price asked for large hides was as much as $50.00 at Winisk. Mr. C. Foreman, Hudson's Bay Company post manager there, explained that this was because of a ready market to American tourists at Moosonee, where the same hide would bring $65.00.

The hide of an adult polar bear sold for $35.00 in the winter of 1951-52, and at the same time two small cub hides sold for $5.00 each. This winter, two three-month old cub hides were sold for $20.00 each at Severn. These prices undoubtedly produce an incentive to hunt polar bears.

Wandering, Hibernation and Parturition

Polar bears seem to range mostly along the coast during the summer months. One striking exception was that of a polar bear seen near the junction of Mink Creek and the Fawn River (100 miles inland) during July or August, 1938.

Mr. J. P. Culliton, of the Provincial Air Service, told us that most of the polar bears he has seen during the summer have been close to ice floes. Summer wanderings are probably closely governed by food supply.

Mr. Culliton also relates that most of the bears he has seen were alone, and only once did he note an exception to this rule, when four were seen. Groups of two or more bears probably consist of the adult female and her previous winter's cubs. Such groups remain intact as late as November, on the basis of an observation made by Fr. Gagnon in 1952.

Indians from Severn and Winisk unanimously agree that female polar bears move inland during November, den up, bear young, then return to the coast during March or April. Some natives claim that males also move inland in November, to escape severe storms, then return to the open leads in Hudson Bay after freeze-up, usually in December. This point is in dispute.

Female polar bears restrict their travelling during the winter months. An adult female killed with its cubs on December 30th, 1952, in a sort of den in the Winisk area, had not moved more than 100 feet from one place during the preceding few weeks.

Indians opine that the adult females usually start to move once their cubs are large and strong enough to travel, which is usually in March.

The cubs taken on December 30th, 1952, seemed to be only three or four weeks old. A Severn Indian killed three cubs during early March, 1953, which he judged to be two or three months old. It thus appears that parturition may occur from late November until early January.

Stefansson (1945) states that "The young are born around midwinter, usually two but never more than that, ...". During March, 1953, Mr. Mason Koostachin of Severn killed an adult female and three cubs, two to three months old, all of which were together. This appears to be an instance of the birth of triplet cubs.

Abundance

The greatest number of polar bears seen during one trip from Severn to Winisk, by Department Officers during the past five years, is four. Many flights are made during which none is seen. This indicates a low population level.

The Ontario polar bear population has sustained a kill of 10-15 during the past few years. We do not know whether this kill is depleting the population. Some Indians at Fort Severn think that polar bears are now more common than formerly.

It is the opinion of the authors that there are not more than a few hundred polar bears in the province.

Future of the Ontario Polar Bear

It seems that purposeful killing of polar bears commenced with the advent of air transportation, and has been intensified by an expanding demand for hides ever since.

In the future, increases in the number of sportsmen visiting James Bay can be expected. Also more and more individuals reach the Hudson Bay coast each year. Each individual tourist wealthy enough to visit the coast is a potential polar bear hide customer.

In addition, personnel from defence installations in northern places are likely to add to the demand for polar bear hides. Some flying wolf hunters have expressed a desire to visit the coast and hunt polar bears.

In short, pressure on the Ontario polar bear is bound to increase. In view of the small population, it seems only a question of time as to when it will be threatened with extinction, unless protective steps are now taken.

Summary

1. The polar bear occurs along Ontario marine coast at least south to Attawapiskat, and inland as much as 100 miles.

2. Total kill of polar bears in the Severn and Winisk Management areas has been 10-15 for the past three years.

3. Animals killed are mostly adult females and cubs.

4. Money appears to be the main incentive to the hunting of polar bears by natives.

5. Polar bears are present in Ontario throughout the year.

6. Parturition occurs regularly in the inland areas adjacent to Hudson Bay, at least from late November until early January.

7. Provincial polar bear population is estimated to be not more than a few hundred.

8. Factors adverse to the future of the polar bear in Ontario are listed.

Recommendations

We feel that the polar bear is now in a position where it should be considered as an endangered species in this province, and that steps should be taken to curtail the future exploitation of the species.

One way, in which this could be achieved, is that the polar bear be prescribed a game animal under the Game and Fisheries Act, and that no open season be proclaimed until further notice.

Literature Cited

Downing, S. C., 1948, A provisional check-list of the mammals of Ontario. Misc. Publ. No.2, Roy. Ont. Mus. Zool. pp. 1-11.

Stefansson, V., 1945, Arctic manual. The Macmillan Co., N.Y. 556 pp.

Addendum 1960. by D. W. Simkin

Little additional information has been accumulated since the above report of 1953 was written.

The annual kill is still running about 10-15 and no increase has been noted in the kill since the construction of the Mid-Canada Radar Line.

This spring (1960), we attempted to collect more information on polar bear at our spring trappers' meetings at Winisk and Fort Severn. Unfortunately we got little tabulatory data from this first effort. However a few general statements can be made as a result of our questioning.

(a) The kill has not increased in recent years.
(b) The main purpose for shooting polar bears is to collect the carcass for dog food (this is contradictory to the statement made in the present polar bear paper.)
(c) The value of the hide has not increased in recent years and if anything has decreased since the days of Mid-Canada Radar Line construction (1957). The average price for good adult hides runs from $15 - $25.00 which is not much considering the effort required to obtain and prepare it.
(d) Most Indians questioned stated that they believed the

polar bear population was at about the same level it has always been.

I would like to repeat the opinion of the 1953 paper and say that we are still concerned with the ultimate fate of this species in Ontario if the hunting and fishing regulations for the hinterland area were liberalized. Undoubtedly this would result in an increased kill by both natives and "sportsmen" to the detriment of this not too plentiful species. It is felt that if hunting and fishing were ever allowed in the hinterland area the advent of tourism in the country would necessitate regulations such as Cringan et al suggested. However at this date there seems to be little danger of overutilization of this species.

PRELIMINARY DEER INVESTIGATIONS IN THE ESPANOLA FORESTRY WILDLIFE MANAGEMENT UNIT, SUDBURY DISTRICT

by
D. A. Mulligan and L. L. Trodd

Abstract

Preliminary deer investigations were carried out in the Victoria - Salter township area of Sudbury District during the period April 28th to May 17th, 1960. This study was instigated when William Maslen, forester for the area, noted severe damage to forest reproduction due to extreme deer browsing. A combined dead deer, area utilization and browse survey was conducted. Thirty-eight dead deer or a calculated seventy-eight per square mile were found. The area utilization was 22,173 deer days per square mile, i.e. 110 deer per square mile or 202 deer per square mile, depending upon what figure is used as the yarding period. The maples (red, mountain, striped and sugar) form the major browse species of the area. While the browse production density for the area was 6,765 stems per acre, this figure is misleading according to the authors insofar as potential food production is concerned. Due to the severity of the browsing, twig development has been seriously retarded. The area has been designated as a forestry-wildlife management unit, to be managed by silvicultural and wildlife management methods, for the production of wildlife and pulpwood. It is recommended that in order to successfully apply such silvicultural methods, a special late season be made to harvest the deer while they are in an accessible area, and thereby reduce the herd to a manageable size.

Introduction

When a species, whether plant or animal, approaches the limits of its natural range, sharp fluctuations in its numbers may be expected. Much of Sudbury's deer range is considered marginal and the fluctuations follow almost as a corollary.

Early in 1959 Wm. Maslen, forester with the Espanola division of the Sudbury district, began to draw up his forest management plans for the area. While cruising Victoria and Salter townships he noted that the regeneration of several species was seriously retarded or completely killed off by excessive deer browsing. With this problem in mind he approached the Fish and Wildlife branch to assist him in drawing up a master forestry wildlife management plan.

Description of the Area

The area covered in this report represents the accessible portion of some 42 square miles of winter deer range lying within Victoria and Salter townships (Map 1). It shows a mixed hardwood-conifer cover with white birch, trembling aspen, sugar maple, red maple, balsam fir and white spruce predominating. Topographically the area is broken up by long granite ridges, which form numerous outcroppings running in an east west direction. Glacial granitic till makes up the soil, varying in texture from a sand to a sandy loam.

The mean snow depth for 1959-60 was 16.2 inches with a maximum of 26.8 inches during the week of February 29th, 1960. Throughout the period February 8th to March 8th there was more than 21 inches of snow on the ground, with an average depth for the period of 25.1 inches.

Information gathered from local residents indicates that the major logging of this area ended during the 1920-26 period. The early fire history of the area is scanty, but it appears that a major fire north of Massey laid bare a large portion of five or six townships in the 1915-16 period. The last recorded log drive occurred in the spring of 1924 on the Sauble River. Some cutting of hemlock in the Walford area took place as late as 1939-40. Since that time the cutting in this area has been confined to the removal of pulpwood.

Reports from the older local residents, including the former game warden, indicate that this area north of Highway 17 supported a high deer population during the 20's, 30's and 40's, with a peak population about 1923-24. Some of the remaining early settlers maintain that there were no deer in the area at the turn of the century and it wasn't until the start of the First World War that they started to appear in the vicinity. They then multiplied rapidly until residents found it was possible to successfully hunt within a short distance of the town. In many cases deer were shot within the town limits. It appears then that the decline started in the early 30's, proceeded gradually until 1945, then speeded up during the 1945-1955 interval. From 1955 to the present time there has been a drastic reduction in the deer herd. This has been very apparent in the number of dead deer found during the past two winters.

Methods

While silviculture plans were being drawn up, preliminary wildlife surveys were started this spring. It had been hoped that an aerial survey during the winter months, of the winter range, might be carried out, but due to inclement weather and conflicting programs the aircraft was not available. We, therefore, relied on the maps prepared during our winter cruises to delineate the study area (Map 1).

A. Yard Utilization

An estimate of the degree to which the deer were utilizing the area during the winter months was obtained from a pellet group count during the period April 28 to May 17, 1960. We are hesitant to base our population estimate on this technique as no record was made of the arrival and departure of the wintering herd. (Very few deer remain beyond the wintering period in the area under study).

Transect lines traversing the topography in a direction N 20 degrees E were run from East to West across the study area. The number of pellet groups found in plots 66 feet by 6.6 feet located at five chain centre to centre intervals along these lines, were recorded. The following formula (1) was used to give us our degree of utilization in deer days:

$$\frac{\text{average no. of pellet groups per plot} \times 100 \times 640}{12.7} = \text{Deer/Sq. Days/Mi.}$$

B. Dead Deer

A dead deer survey was carried out coincidental with the yard utilization and browse surveys. Two wing men paralleled at a distance of one chain the centre man who compassed the transect lines. All carcasses falling within the three chain strip were recorded as winter kills. Since it soon became evident that most of the carcasses were torn up by wolves and/or foxes and dogs, we had to decide what would constitute a carcass. Four legs or one leg and a skull were considered the minimum parts necessary to be recorded as a carcass. At each carcass; a search was made for additional bones and when carcasses were found on adjacent plots or lines a check was made to determine the exact number of animals found. Condition of the carcass, age, marrow conditions, location and forest type were recorded wherever possible (Table II). Jaws of animals older than age class one were collected wherever possible. Dead deer per unit area (square miles) was calculated from the following formula (2):

$$\frac{\text{No. of dead deer found} \times 43{,}560 \times 640}{198 \times \text{total length of survey lines}} = \text{dead deer per square mile.}$$

C. Vegetation

As previously indicated a browse survey was conducted simultaneously with the yard utilization and dead deer surveys. At each plot examined for crotesings a wing man would come in to assist the chain man in tallying while the other man did the recording. The method followed was a modification of the Passmore-Hepburn technique (1955). Total number of stems per species per plot was recorded with number browsed per species per plot (i.e. % stems browsed) replacing the usual information on twig browsing recorded under "B" column of the tally form. Available browse was considered to be that portion of the trees and shrubs between 1.5 feet and 6.5 feet above the ground. Mutilation and mortality brought about by excessive browsing, were also recorded. A description of the forest stand and site was made for each plot.

Survey Results and Discussion

The Victoria yard is an old established wintering area for deer. The damage to regeneration, brought about by the herd, is outstanding and it is evident that corrective measures must be taken to assure the perpetuity of both the deer and the forest. Without these measures we can expect a continued decline of the herd and further damage to regeneration. How to reduce the herd so that cutting practices will stimulate additional regeneration and browse production is our foremost problem. It was noted during the hunting season November 1 to November 25, 1959, the number of deer harvested from this area was remarkably low when compared to the wintering population. Further observations have indicated that the deer move into the area late in December. With this situation existing it is almost impossible to appreciably reduce the herd size by legal harvesting during the present season. We will concede that if the situation is allowed to continue as it is today the herd will be reduced to the level we desire, but those deer lost through predation, starvation, accident, etc. would be better utilized from the public's and our standpoint, if legally harvested. The need of a legal reduction of the herd brings up our first management recommendations, -- that a special season be passed, that the length and dates of the season be determined by those in charge of the project, that the area be heavily enforced during the season and data and material be collected during the harvest.

A. Wintering Concentration

Nine hundred and five pellet groups were found on the 204 plots taken along the transect lines. This is an average of 4.4 crotesings per plot. Using formula (1) the calculated utilization of the area by the deer herd is 22,173 deer days.

$$\frac{4.4 \times 100 \times 640}{12.7} = 22{,}173.4\text{/square mile.}$$

4.4 - average number of crotesings per plot;
100 - conversion factor to acres;
640 - number of acres per square mile;
12.7 - theoretical number of crotesings deposited per deer per day.

B. Dead Deer

A total of 38 carcasses were located along 13 miles of transect lines. This figure inserted in formula (2) produced a calculated winter kill of 78 per square mile.

$$\frac{38 \times 43{,}560 \times 640}{198 \times 68{,}508} = 78.1\text{/square mile.}$$

38 - number of dead deer found;
43,560 - number of square feet per acre;
640 - number of acres per square mile;
198 - width of survey strip in feet;
68,508 - length of survey line in feet.

While this is a higher calculated winter mortality than was found in any of the districts surveyed in the spring of 1959, it is not surprising when the situation is analyzed.

1. The area produces a minimum of winter cover and browse.

2. The area supports a high concentration of deer during the critical winter period.

3. At least one pack of wolves traverses the area regularly during the critical period and during the 1959-60 season four dogs were shot in the area while running deer.

Combining the calculated winter mortality and winter area utilization figures, a clearer picture of the problem develops. If we assume the leafless period, i.e. the wintering period, to be 200 days, we calculate that our wintering concentration in the area surveyed to be 110 deer per square mile. Based on this figure and the calculated winter kill figure, we might then assume that our winter losses were 70% of the wintering herd. However, as noted before, the herd does not move into the Victoria yard before late December and our observations indicated they had left by mid-April. This then gives us a wintering period of approximately 110 days and a concentration of 202 deer per square mile. With this figure we might then assume that our winter losses from the Victoria herd to be in the neighbourhood of 39%. This is perhaps a more realistic figure in view of the conditions present.

C. Browse Conditions

One hundred and fifty-four plots were examined for browse conditions. The results may be found in Table III. Species are listed in order of per cent relative density, showing the number of living stems of each species per acre and the degree of browsing each species received recorded as per cent stems browsed. The number of dead stems per acre is also recorded in this table as is per cent relative frequency of living stems. Mutilation was noted to be high particularly in those species which showed heavy 1959-60 utilization.

The maples, red, mountain, striped and sugar appear to be the most important browse species of this area from a utilization availability standpoint. Figure II illustrates the availability distribution picture of the leading species of the area. Per cent relative density indicates the order of abundance of the species present while per cent relative frequency indicates the distribution of these species. For example, while hazel ranked second in abundance its lower per cent relative frequency indicated a greater degree of clumping and lower distribution throughout the area. Sugar maple, on the other hand, with a high per cent relative frequency shows a more uniform distribution.

Thirty woody species were recorded present as available browse in the area. The four maples plus hazel made up 60% of this available browse. Balsam fir while constituting only 5.4% of the available winter food, undoubtedly plays a more significant role in browse availability due to its growth form.

D. Timber Types and Their Utilization

The forest type was classified according to the following method:

Conifer	Over 75% conifer
Conifer-hardwood	50-75% conifer
Hardwood-conifer	25-50% conifer
Hardwood	0-25% conifer
Swamp	Bogs and swamps (excluding cedar)
Open	Rock outcroppings

It was found using this method that the cover composition of the area was as follows:

Hardwood	39%
Conifer-hardwood	13%
Conifer	17%
Hardwood-conifer	15%
Open	12%
Swamp	4%

If the degree of utilization of each cover type is compared by calculating the percentage of crotesings found under each type, we find:

Hardwood	29%
Conifer-hardwood	23%
Conifer	21%
Hardwood-conifer	18%
Open	8%
Swamp	1%

Figure 1 - compares the percentage of sample plots located in different forest stands and the degree of utilization as indicated by the pellet group count. It should be noted that the cover composition which is 50% or more conifer, receives more than 40% utilization, while only showing a 30% availability. This should be kept in mind when cutting and reforestation plans are drawn up. Heavy interspecific competition was noted in many parts of the area under examination. Mouse damage was particularly prominent, with girdling of the maples and birchs outstanding. Several snowshoe hareswere seen during the study and in many instances hare browsing was recorded.

Summary and Conclusions

The Victoria yard was mapped by a ground crew during the winter of 1959-60. The portion of the yard examined during May 1960 is assumed to have supported a wintering density between 110 and 202 deer per square mile. The winter mortality of the area examined was calculated to be 78 per square mile, i.e. 70% or 39% of the wintering herd population depending upon which wintering density is used in the calculation. We feel the latter density and mortality rate are the most realistic.

An attempt must be made to reduce the herd before silviculture practices are applied to improve habitat conditions. A late hunting season is recommended.

The area has produced a good quantity of browse, 6765 stems per acre, but due to the heavy concentration of deer the browse potential is being exceeded by the intensive utilization. This production density figure of 6765 may be misleading if considered as a browse availability value. Severe browsing has retarded twig development and if the same browsing pressure is applied to this regeneration in the future it is expected that heavy sapling mortality will result.

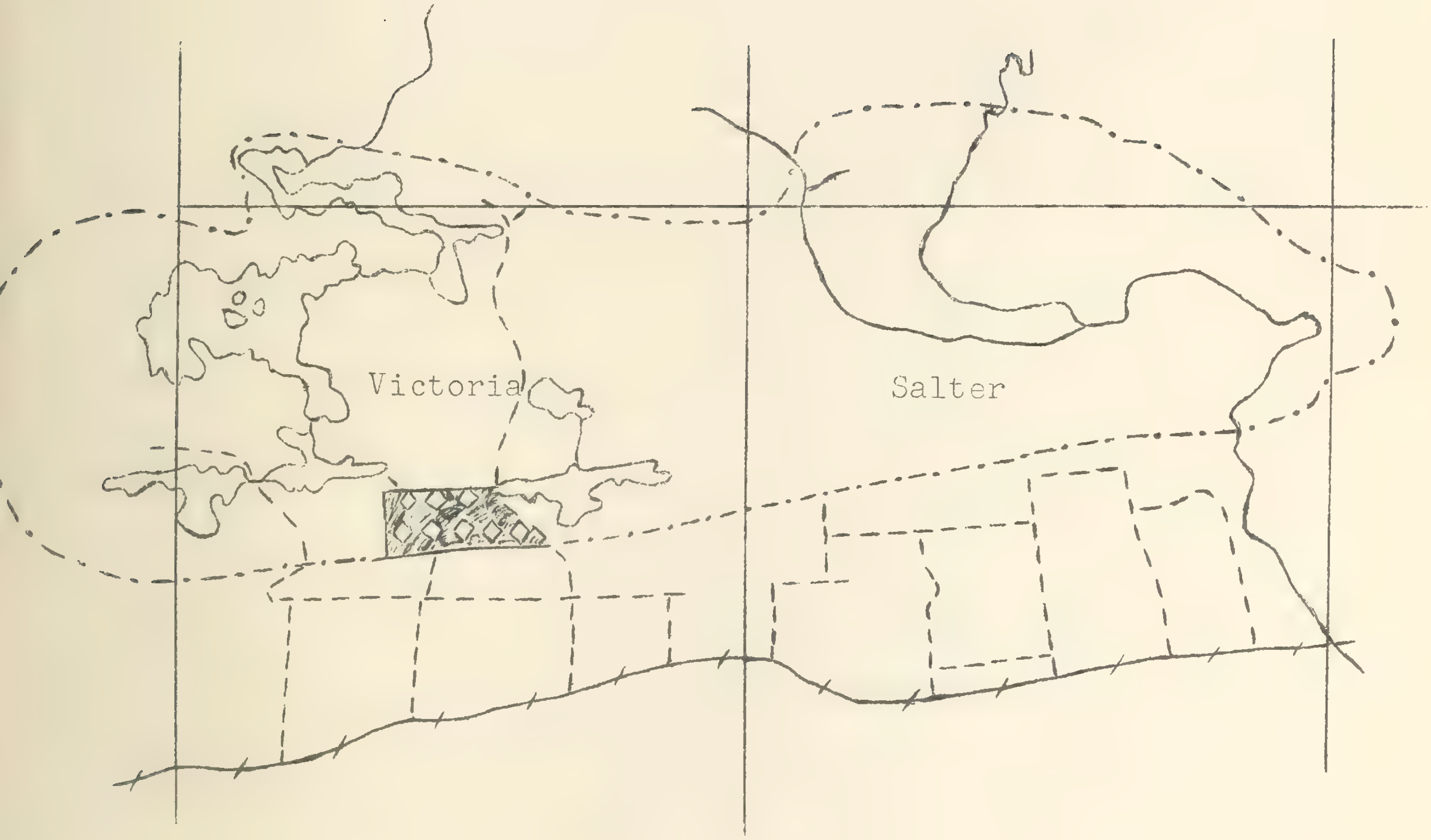
The more shade tolerant species, particularly the maples make up the bulk of the available winter food. This may be due to a combination of past forestry practices plus the exceedingly high deer concentrations. Situated in an area where pulpwood production is an important industry the removal of conifers such as balsam fir and white spruce plays an important part in altering the forest composition.

With the high deer density present in the area there appears to be very little hope of immediately improving the area surveyed for pulpwood production. We would, therefore, suggest that it be managed, in the future, as a combined wildlife-forestry unit, through silvicultural and wildlife techniques. The initial attempt will be to increase the regeneration and sucker production of certain preferred browse and cover species.

Acknowledgments

We are indebted to Don Hughson and Doug. Gillespie for their assistance in conducting the survey and to Bill Maslen for the interest he has taken in the project. Credit must also be given to Charlie Bibby and Doug. Gillespie, for without their help and criticism, this brief might never have been written.

MAP NO. I -



▨ - Area Sampled

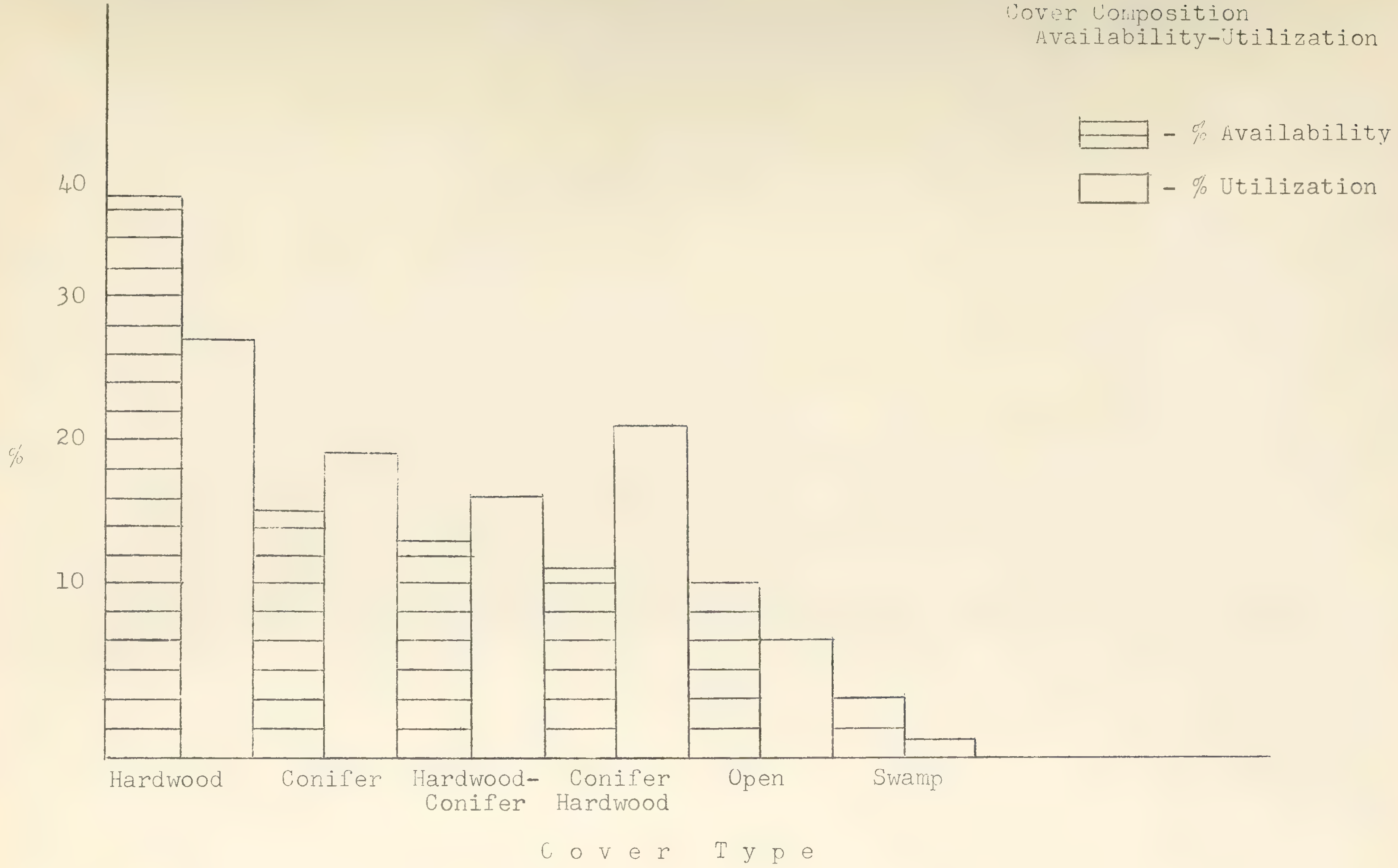
-·-· - Boundary of Wintering Area

- - - - Township Roads

∼ - River

+++ - Highway No. 17

FIGURE NO. I -



Cover Composition
Availability-Utilization

FIGURE NO. II - Comparative % Relative Density
% Relative Frequency

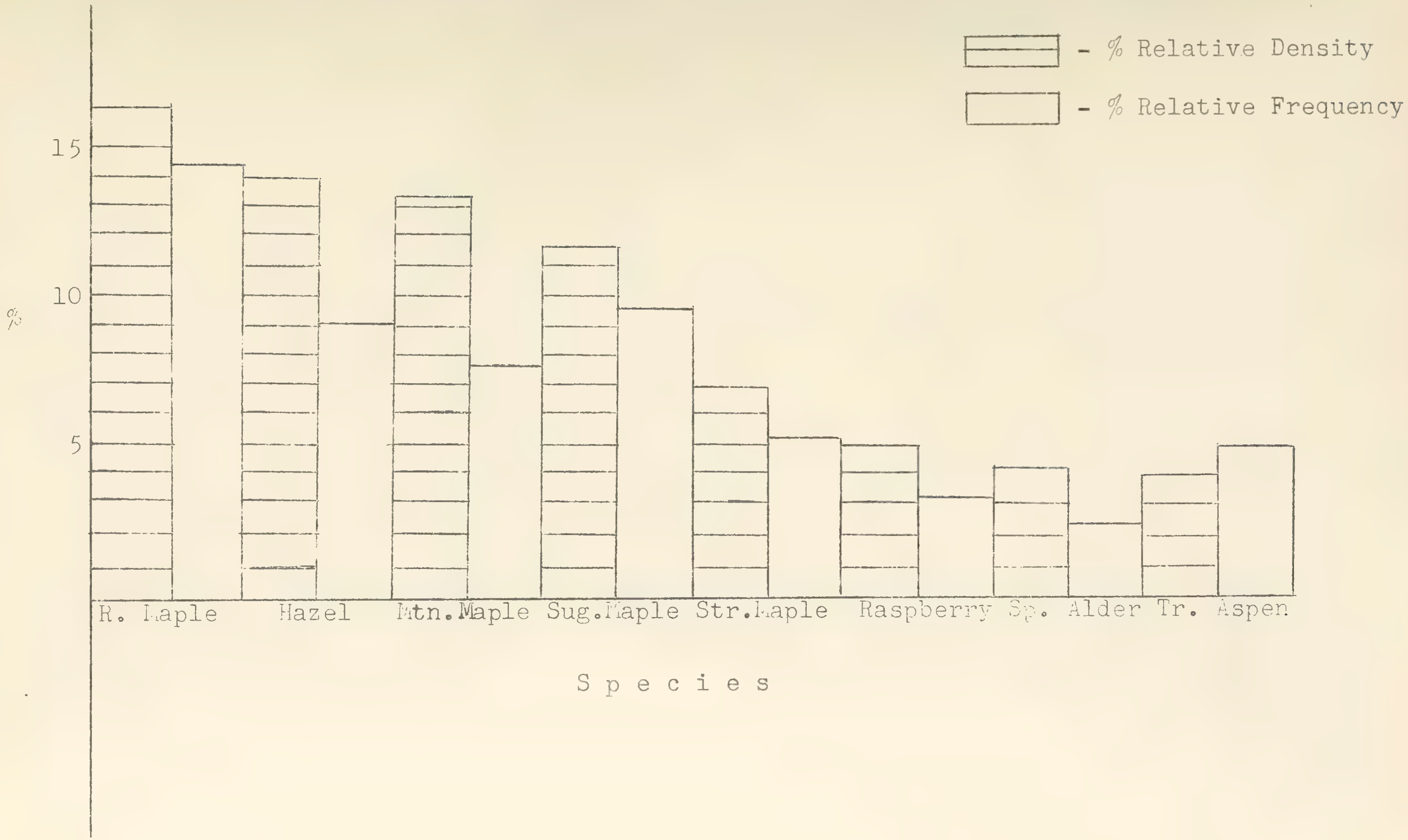


TABLE II -

Hardwood	Conifer	Open	Swamp	Hardwood-Conifer	Conifer-Hardwood
B ??	B ??	B ??	B ??	B 1♂	B ??
B ??	B ??	S ??	B 6♀x	B ??	B ??
B 3♂	B 1?	T ??		B ??	B 1?
S ??	B 1?	T 1?		B ??	B ??
T 3♂	B 1?	T 5♀		B ??	B ??
T ??	S ??			B ??	S ??
				S 1?	S ??
				T ??	T ??
					T ??
					T ??
7	6	5	2	8	10

Age class -	1	2	3	4	5	6	?
Number found -	7	0	2	0	1	1	27

Location	Bottom	Top	Side
Number found	23	9	6

Legend

x = Femur marrow red and gelatinous

B = bottom T = top S = side of ridge

? = age unknown ?? = age and sex unknown

1 (numeral) - age class ♂ or ♀ = sex

TABLE III -

Species	No. Living Stems/Acre	No. Dead Stems/Acre	Percent Utili-zation	Percent Relative Density	Percent Relative Frequency
Red Maple	1115	13	80	16.5	14.7
Hazel	960	23	35	14.2	9.1
Mountain Maple	917	53	82	13.6	7.9
Sugar Maple	798	47	47	11.8	9.7
Striped Maple	489	13	94	7.2	5.3
Raspberry	345	0	6	5.1	3.4
Speckled Alder	300	0	12	4.4	2.5
Tremblin Aspen	277	15	52	4.1	5.1
Balsam Fir	232	21	30	3.4	7.4
Willow	204	9	40	3.0	5.1
Sumac	183	28	100	2.7	2.3
Black Ash	183	2	20	2.7	2.8
White Birch	166	21	33	2.5	5.0
Honeysuckle Sp.	162	0	9	2.4	3.8
Unidentified Sp. A.	109	0	26	1.6	1.1
Large Tooth Asp.	74	19	74	1.1	3.4
Blackberry	49	4	65	-1.0	1.1
White Pine	45	2	0	-1.0	3.0
White Spruce	43	4	20	-1.0	2.8
Balsam Poplar	34	4	56	-1.0	1.3
Red Oak	26	0	12	-1.0	-1.0
Black Cherry	21	0	0	-1.0	-1.0
Hornbeam	11	0	0	-1.0	-1.0
Red Elderberry	6	2	100	1.0	-1.0
Pin Cherry	6	4	67	-1.0	-1.0
Elm	2	0	0	-1.0	-1.0
Yellow Birch	2	0	100	-1.0	-1.0
White Cedar	2	0	100	-1.0	-1.0
Red Pine	2	0	0	-1.0	-1.0
Hemlock	2	0	0	-1.0	-1.0

Since filing our report on the Massey Forestry - Wildlife Management Unit investigations, we have been receiving questions from several quarters regarding the same. The foremost question concerns the proposed late season harvest.

In preparing our report we were reluctant to expand on several of the points brought out due to the lack of time for proper analysis and the desire to outline what we had found as factually and concisely as possible. We are sorry if this brevity left loopholes in our story and hope that this explanation of our late season proposal will further clear the picture of the situation as it exists in our area. Four points stand out which suggest that a late season harvest would be a wise management tool in this situation.

1. The wintering area shows serious signs of over-browsing and a reduction of the herd (i.e. browsing pressure) is of absolute necessity before silvicultural practices can be expected to stimulate the browse and cover production necessary to improve the area.

2. The overall area where the deer are to be found throughout the year is relatively inaccessible due to a lack of roads and the rugged topography of the country. It is not until approximately mid-December that the deer move into the southern portion of their range where a few roads will provide hunter access.

3. A late harvest in this critical area may provide us with further information on the age class distribution and condition (i.e. parasite and disease burden) of an overpopulated deer herd. Due to the nature of the road system and the timing of the season, we should be in a position to examine thoroughly a large portion of the animals removed.

4. The last and probably the most basic point for this recommendation is that the suggested harvest is a wise and realistic use of our natural resource which at the present time is being wasted by underharvest.

To enlarge on the foregoing points of our proposal, we would like first to delineate the area that might be considered for the hunt. The area is penetrated to the north from Highway #17 west by eleven roads. Two roads Highway #553 (the Massey Tote Road) and the Waterfalls Resort road running north from Spanish, penetrate the country to the greatest extent in a northerly direction. These two roads will serve as the bases of our east and west boundaries. The eastern boundary will be Highway #553 north to Paddies Creek while the western limit will be the Waterfalls Resort road north to Crabb, Lang, Little Serpent and finally Bellows Lake, which serves as the north-west corner of the proposed hunting area. Running east from Bellows Lake through Snapshot, Bean and Paddies Lakes to Paddies Creek on the eastern periphery will be the northern limit of the hunting ground. Highway #17 west from Massey to Spanish will serve as our southern line. The enclosed map* shows the limits of the wintering area, the access roads and our proposed boundaries. *(This large map accompanied the original report and is on file in the Maple Fish and Wildlife library).

With the end of our normal deer and ruffed grouse season the personnel of the Sudbury District will be in a position to concentrate on this special enforcement problem. The area is nicely located through its restricted road system to facilitate hunter checks.

Setting the dates of the season will be a minor problem. The movement of the deer into the wintering area is governed, to a large extent by the weather. As we have pointed out before our observations indicate that yarding begins approximately mid-December and the deer are in an area where a harvest would be practical. Should a special season for 1960 be not feasible, we would like to check further this winter, before setting an opening date. If a 1960

season is in order, Monday, December 12, 1960 would serve as a suitable commencement of the hunt. The length of the harvest is another problem. Ideally the duration of the hunt should be determined by the harvest. If we could calculate an allowable kill, perhaps based on our winter kill figure, we might attempt to close the season when our calculated kill is attained by the hunters. However, due to the enforcement difficulties we might encounter, with such a programme, we would like to recommend a seven day harvest.

Finally, we were aware that such a precedent setting season might be met with some opposition by the local residents and accordingly approached them with our idea. Our proposal has met with no opposition to date. We intend to hold a meeting at a later date to discuss the problem and let the residents voice their feelings.

References

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A method for appraisal of winter range of deer. Ont. Dept. of Lands and Forests, Research Branch, Techn. Bull., 7 pp.

RECOMMENDATIONS FOR DEER MANAGEMENT ON ESPANOLA MULTIPLE USE MANAGEMENT UNIT

by
H.G. Cumming and A.B. Stephenson

Abstract

Victoria and Salter townships in the Espanola Management Unit of Sudbury district are to be used for experiments in combining the management of timber and deer. The area is described and its position on the northern edge of deer range is emphasized. General principles to be followed in planning timber operations to include benefits to deer lead to specific suggestions for these areas. It is suggested that the experiment would not be complete without an effort to assess the effectiveness of any management procedures that are undertaken.

This report presents recommendations for deer habitat management on the two townships of Victoria and Salter in Espanola Management Unit of the Sudbury District. The two townships have been suggested for an experiment in multiple use management. Included in the over-all plans would be an effort at deer habitat management. In particular, an attempt would be made to integrate the management of deer and timber on the area. The recommendations included in this report are concerned with the improving of deer habitat by silvicultural methods.

The area in questions is on the Pre-Cambrian Shield. This means that it is not highly productive for deer, because only inferior quality deer food can be produced on Pre-Cambrian soils. The original stands on the area were mostly white pine. These were cut long ago and a second growth of mixed intolerant hardwoods and conifers is now reaching the merchantable stage. It is at present heavily over-utilized by deer in some places due to the reduction of available browse by the maturing of the forest. This will have an effect on future forest composition because balsam is being suppressed on these areas. With this deteriorating browse condition on our hands we must either improve the habitat or be satisfied with much lower levels of deer than have been present in the past.

We must realize that this part of Ontario is on the extreme northern edge of the deer range. A few deer can be found farther north but the great concentrations of deer are more to the south. The accumulation of deep snow on the ground in combination with cold winters seems to be the limiting factor in the northward spread of deer. Since this area is near the extremity of the deer range it is inevitable that occasional hard winters will reduce the deer population. Despite this fact there is no reason why substantial numbers of deer

cannot be maintained through normal winters. The occasional losses will just have to be anticipated and ignored.

Because of the unfavourable environmental conditions all survival factors become critical. Good supplies of food are required to maintain the deer throughout the hard northern winters. On this area the browse will mainly be supplied by hardwood and balsam regeneration. Shelter is also essential in protecting deer. Hardwoods are of little value for shelter so we must turn to conifers to provide this requirement. Thus, it becomes necessary to maintain a proper mixture of hardwood and balsam regeneration with adequate coniferous cover in order to maintain maximum deer production. We wish to bring this about through planned silvicultural operations.

Some general principles can be stated with which all future silvicultural operations should conform in order to be of most benefit to deer:

1. Any cutting of hardwoods will be beneficial to deer by providing more food.

2. Large stands of conifers with over fifty per cent crown density should be broken up. The interiors of such stands are of little value to wintering deer due to the distance deer would have to travel to find food. When the conifers are broken into small stands the deer can use them for shelter and range into the surrounding young regeneration for food.

3. All cutting units should be kept small in size. No single block of over five acres should be cut.

4. Immediate cutting operations should be directed near known deer wintering areas. It may be possible to establish cutting plans so that future operations will gradually radiate from the present deer wintering areas. In this way deer will be drawn from their present over-browsed yards into the nearby regeneration. Cuts that are located too far from present wintering areas may not be found by deer for some years.

5. The management plan for the area should establish a rotation system of cutting to ensure an optimum interspersion of coniferous cover and regeneration for food.

If these general management procedures are followed there should soon be an improvement in present deer food supplies. Available food would then be maintained at a fairly constant level to provide conditions suitable for a stable deer herd. We do not anticipate any problems with deer suppressing regeneration because of the location of the area in the extreme limit of the deer range and because of the large quantity of regeneration which will develop under controlled cutting.

From general suggestions we can go on to specific management techniques. In order to direct immediate cutting into or near deer yards we must know where the yards are. This means that an aerial mapping of the deer yards is required. Such mapping may have to be

undertaken annually if the deer move around very much. When cutting within deer yards only hardwoods should be cut. The conifers should be left to provide shelter. In cuts outside deer wintering areas both hardwoods and conifers can be cut. Strip cuts, block cuts and selection cuts are all beneficial to deer. Strip cuts should be run north-east and south-west as the best compromise between the requirements of good regeneration and good deer utilization. The strip should be about two chains wide out of a ten chain cutting unit. Then if four years are allowed between cuts, the total unit will have been cut in a 20 to 24 year period. By this time regeneration on the first strips should be such that it will provide shelter for deer feeding on the more recently cut strips. Block cuts may be of any irregular shape depending on local topography and timber stands but should be restricted to two or three acres in size. Selection cuts can be used for removing the hardwood from deer wintering areas.

It is doubtful if any planting would be of much benefit toward the goal of increasing deer food. Since this is not a limestone area it is not expected that cedar would ever be of major importance. If planting is undertaken, it should be carried out in areas where the seedlings will not be initially vulnerable to browsing, i.e. remote from present deer yards. Some stimulation of growth may be accomplished by brushing out shrubs with axes, by using herbicides and controlled burning and by scarifying with bulldozers equipped with root rakes. However, it is expected that regeneration satisfactory for forestry purposes would also provide adequate food for deer.

In order that we may determine the effectiveness of these management methods we strongly recommend that some effort be made to assess the results. Three techniques may be used. A control area may be established within the management unit so that conditions in the cutting areas may be compared with those which would have occurred if no cutting had been undertaken. Spring browse surveys, pellet group counts and dead deer counts should be undertaken by the Fish and Wildlife Branch. No permanent lines should be put in for these but permanent survey units should be mapped out. If five units were set up to be done on a six year rotation for browse surveys and three years for pellet group counts, the production of food and numbers of deer in each survey unit could be compared with original estimates when the re-survey is carried out. The Fish and Wildlife Branch should also undertake to make some estimate of the number of deer killed by hunters during the open season each year. The accuracy of such estimates will depend to a large extent on how well it is possible to control the access of hunters to the area, but at least an effort should be made to find out if there is any increase in hunter success.

It is felt that this undertaking should be treated as a pilot project and a report should be published as soon as any definite results are obtained. Such a report should help to expedite similar habitat management efforts in other deer problem areas throughout Ontario.

KENORA DISTRICT WOLF INVENTORY, 1959-1960

by
M. Linklater

Abstract

Information is given on distribution, population data, sex ratios and expenditure for bounty claims on wolves in the Kenora District. The major range of the timber wolf is in the western portion of the District in an area of approximately 6,000 square miles with wolves and deer occurring in good numbers. The brush wolf is present in fewer numbers being found mainly adjacent to settled areas. It is considered relatively unimportant as a predator of big game at the present time. During the fiscal year ending March 31, 1960, some 177 timber and 35 brush wolves were presented for bounty representing a total expenditure of $5,300.00. The sex ratio of bountied timber wolves was 161 males to 100 females while the sex ratio of brush wolves was 63 males to 100 females. The population of wolves based on the number harvested from year to year appears to have remained fairly stable.

Introduction

Information contained in this report concerns wolves in the Kenora Wildlife Management District, hereinafter called the Kenora District, an area of approximately 14,900 square miles.

Two species of wolves are found in the District, namely the timber wolf, (Canis lupus) and the brush wolf (Canis latrans).

The timber wolf is of primary importance because of its distribution and numbers throughout our better deer range.

Not so important as a big game predator is the brush wolf. The major part of this report will, therefore, deal primarily with the timber wolf since this species is present in greater numbers. Some brief data on the brush wolf will be included in the final analysis.

Timber Wolf Distribution

It is apparent that although deer and wolves occur throughout the entire District, they are found concurrently in greater numbers in the western portion of the District. The major range of this carnivore embraces an area of approximately 6000 miles. This area is

bounded on the west by the Manitoba border; embraces the Lake of the Woods, extends eastward to the vicinity of Vermilion Bay and north into the Sioux Lookout District. (see attached map) The basis for employing only two colours on the map of comparative abundance is that it illustrates much better the major timber wolf range as it appears at the present time. The number of wolves may vary within this range. They are spotted frequently during the winter months, with sign being very common. There are areas within the blue colour scheme that perhaps harbour more wolves than elsewhere, but to try and isolate these areas would be misleading at best. There is no doubt that the range of the various packs overlap one another throughout the major range of this animal.

Population Data

It is not possible to determine the actual number of wolves harboured in the District at the present time, and to try and estimate the population would be strictly guess work on our part.

We feel that all we can do for the present is to record the trend based on the number of animals harvested from year to year. Data extracted from wolf bounty records for the past nine years indicate the population has remained fairly stable during this period. Fluctuations in the harvest appear from year to year but only on a minor scale.

The greatest number of wolves harvested in any one year during the nine years was in 1957-58 when 236 wolves were killed. The mean production for the nine years was 153 wolves annually or one wolf harvested for every 88 square miles in the District.

All wolf kills for the above period of time were plotted on a 24A map of the District. When this work was completed, it was obvious that the eastern part of the District is relatively unimportant as timber wolf habitat.

An analysis of the foregoing data shows that approximately 90 percent of all wolves harvested originated from the western portion of the District. Applying these data to the major timber wolf range indicates that one wolf was harvested for every 40 square miles of territory lying in this area.

Bountied Wolves

During the fiscal year ending March 31/60, a total of 177 timber wolves were presented for bounty purposes. Of this number, 160 were taken in the Kenora District. The remaining 17 wolves were killed elsewhere but were processed through this District Office.

The annual harvest of wolves is governed largely by the amount of pressure applied by airborne hunters. During the past year there were 45 permits issued to hunt predatory animals from aircraft. As usual, this category of hunters accounted for over 50 percent of the total kill. Trappers snared about 30 percent while the remaining 20 percent was accounted for by other methods.

Bounty claims processed through our District Office amounted to $4,425.00 on timber wolves and $875.00 on brush wolves, a total of $5,300.00 which is just about average for any one year.

TABLE I - Sex Ratio of Timber Wolves - April 1st, 1959 to March 31st, 1960

Method of Kill	Numbers Killed		Totals	Sex Ratios	
	♂	♀		♂	♀
Snared	23	17	40	135	100
Trapped	8	7	15	114	100
Shot	11	7	18	157	100
Aircraft Kill	58	32	90	181	100
Cars, etc.	2	2	4	100	100
Unspecified	3	nil	3		
TOTALS	105	65	170	161	100
Sex Unknown			7		
GRAND TOTAL			177		

An analysis of bounty records dating back to 1951 indicates a preponderance of males to females. The mean ratio for the nine year period being 149 males to 100 females. The sex ratio for the past year was no exception as shown in the foregoing table. It is not known whether this unbalance is due to the method of harvesting or not. The only method of kill which shows a more balanced ratio for the nine year period is that of trapping; two years out of the nine show more females killed than males by this means. It may be that trapping is the impartial method to properly assess the sex ratio but the number taken each year by this method is far too small to prove conclusively that this is the case.

The Brush Wolf

The brush wolf or coyote as it is sometimes called is present but in fewer numbers than the timber wolf.

This species is found more or less adjacent to areas that have been settled. It is believed to be relatively unimportant as a predator of big game at the present time. However, it is important enough to warrant the same attention as given to the timber wolf.

During the past year, a total of 35 brush wolves were killed in the Kenora District. This number represents an increase of 22% over the previous year's harvest when 27 were presented for bounty purposes.

TABLE II - Sex Ratio of Brush Wolves - April 1st, 1959 to March 31st, 1960

Method of Kill	Numbers Killed		Totals	Sex Ratios
	♂	♀		♂ : ♀
Snared	1	nil	1	-
Trapped	nil	1	1	-
Shot	1	5	6	20 : 100
Aircraft Kill	7	8	15	87 : 100
Other	nil	4	4	-
Unspecified	3	1	4	300 : 100
TOTALS	12	19	31	63 : 100
Sex Unknown			4	
GRAND TOTAL			35	

Summary

The Kenora Wildlife Management District encompasses an area of approximately 14,900 square miles.

The major range of the timber wolf is situated in the western portion of the District, or in an area of approximately 6,000 square miles with wolves and deer occurring concurrently in good numbers.

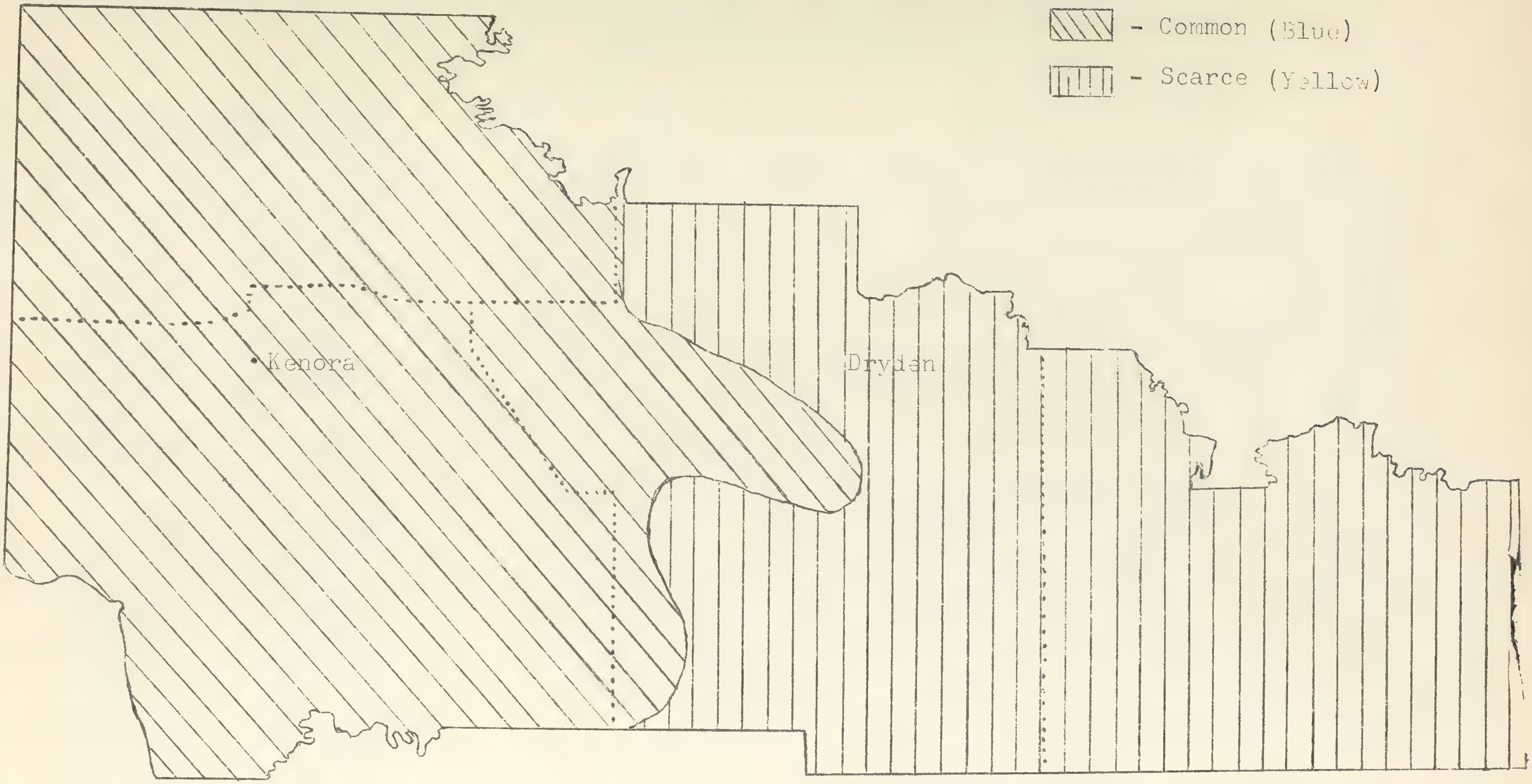
During the past year, a total of 177 timber and 35 brush wolves were presented for bounty purposes representing a total expenditure of $5,300.00.

The sex ratio of bountied timber wolves was 161 males to 100 females. In direct contrast is the sex ratio of brush wolves of 63 males to 100 females.

The population of wolves, based on the number harvested from year to year appears to have remained fairly stable with only minor fluctuations in numbers.

During the past year one wolf was harvested for every 88 square miles in the District. All wolf kills were plotted on a map of the District. This work, when completed, indicated that approximately 90% of all wolves harvested originated from the western portion of the District. Applying these data to the major timber wolf range indicates that one wolf was harvested for every 40 square miles in this area.

Kenora District Timber Wolf Distribution



IMPOUNDMENTS IN ONTARIO (1957)

by
J. M. Fraser

Abstract

In order to make a general appraisal of impoundments in Ontario, a one month's inspection tour of some 18 Ontario impoundments was undertaken. In addition, visits were made to the Tennessee Valley Authority and the office of the U. S. River Basin Studies at Boston. Ontario impoundments fall into two types; those created to produce hydro-electric power and those designed for flood control. The majority of hydro-electric impoundments are located on water systems inhabited by warm water species of fish. Angling pressure here may be classed as very light to moderate and angling success comparable to that of non-controlled waters. Topics such as size, site, recreational aspects and the effect of water level manipulation on fish populations are discussed. With the location in more densely populated southern Ontario of impoundments for water control, fish, wildlife and especially recreational aspects of these impoundments take on greater significance. Although certain generalizations may be made on impoundments each is deemed sufficiently different from the other to make specific recommendations hazardous. In general, it is recommended that a multi-purpose concept be adopted as policy and that branches responsible for land, water and fish and wildlife maintain an integrated approach to the uses of impoundments. A closer liaison between the Department and the agencies or authorities which operate dams is also recommended.

Introduction

The purpose of this paper is to provide a general appraisal of the impoundments located in Ontario and the relationship of fish, wildlife and recreational values to these impoundments. This appraisal is based on a one month's tour of some eighteen Ontario impoundments during which time the writer inspected the impoundments, conversed with the regulating authorities, local Lands and Forests personnel and other interested persons.

The writer was also fortunate in having the opportunity to visit the Tennessee Valley Authority and the office of River Basin Studies of the United States Fish and Wildlife Service at Boston, Massachusetts. From the personnel associated with the above agencies the writer received information based on considerable experience with impoundment problems.

It should be stated in this introduction that this paper is one of impressions and that these impressions must be qualified by the limited amount of time the writer has had in which to consider such a vast and many sided situation. Assuredly some of these impressions are not based on full recognizance of the problems involved.

Types of Impoundments

There is a great variety of impoundments in Ontario differing in age, size, purpose, manipulation and watershed location. These impoundments have been created to provide water for hydro power, logging purposes, domestic and other uses; also to control floods and regulate stream flow. They range in size from the small farm ponds of less than one acre in area to the large natural lakes with controlled water levels. In this paper impoundment refers to any body of water with a level controlled by a dam.

The larger Ontario impoundments are the main interest of this paper and they are simply classified as:

1. Impoundments created primarily to produce hydro-electric power.

2. Impoundments created for flood control (with secondary purposes).

A total of eighteen impoundments was visited by the writer and of these fourteen were regulated for hydro-electric power and four for flood control.

Acknowledgments

The writer wishes to express his thanks to Dr. W. J. K. Harkness, Chief, Division of Fish and Wildlife for the opportunity to carry out this study. He is also indebted to many Lands and Forests personnel and the operating authorities of Ontario impoundments for the information and cooperation they have provided. The personnel of the Tennessee Valley Authority and the Office of River Basin Studies in Boston were most kind and cooperative in providing the benefit of their experience.

I HYDRO - ELECTRIC IMPOUNDMENTS

A large percentage of the major impoundments in Ontario have been created to store water for the generation of hydro-electric power. These impoundments are located on the larger accessible watersheds located throughout Ontario. Of the fourteen impoundments visited during the tour all but two were located in northern and northwestern Ontario. These impoundments differ in many ways and an attempt is made to discuss them under the following headings.

Age of Impoundment

Half of the impoundments visited were created within the last 10 years through an increased expansion program of the Ontario Hydro-Electric Power Commission. The older impoundments, some dating back to the 1800's were created by private power concerns.

Size of Impoundments

The size of the hydro-electric impoundments varies considerably depending on the size of the watershed, topography of the area and size and location of the dam. Some are natural lakes in which storage capacity has been increased by erection of a dam at the outlet with resultant flooding of shoreline areas. Where dams have been constructed across rivers the storage capacity is in depth rather than area, depending on the topography of the region. The Otto Holden dam on the Ottawa River for example has changed this rapid flowing portion of the river into an elongated impoundment with a maximum depth of over 100 feet. On the other hand a dam now being constructed on the slower flowing English River will lead to the flooding of 22,000 acres for water storage.

Lake of the Woods was the oldest and largest impoundment visited. It is a natural lake of some 1300 square miles in area which was dammed at the outlet in 1876 for the control of international waters and for hydro-electric power. In the same region is Lac Seul with a water area of 600 square miles. The other impoundments are considerably smaller, some retaining their river characteristics. The smallest impoundment, Eugenia Pond in Southern Ontario, is a true impoundment of 2200 acres created forty years ago by damming a small river and utilizing a natural depression for water storage.

Preparation of Site Prior to Impoundment

Many of our impoundments are located on what was previously heavily forested land. The usual procedure has been to clear the site prior to impoundment. In clearing the site all standing trees were cut, the merchantable timber removed and the remainder piled and burned. This procedure has been followed to various degrees of efficiency. When the Des Joachims Dam on the Ottawa River was constructed in 1950, 12,000 acres of forested shoreline had to be cleared. All trees were cut but owing to various difficulties only a portion of the timber was removed or burned. In 1957 salvage operations were still being carried out to remove floating wood from the impoundment.

Other impoundments are more-or-less clear of debris depending on the efficiency of the original clearing and the time since impoundment. In some impoundments debris has been boomed off into small bays.

In northwestern Ontario the largest forest clearing for water impoundment in Ontario is being carried out on the English River where 22,000 acres of forested land are to be flooded. Here, the merchantable timber will be removed but the non-merchantable birch and poplar will be felled and left lying on the ground instead of being burned. This is a trial procedure for Ontario and is based on the experiences of the Quebec Hydro Commission. According to experiences in Quebec the felled timber should sink within two years. If this experiment is not successful salvage operations will have to be carried out to remove floating debris from the impoundment.

The outstanding example of flooding standing timber is Lac Seul which is also part of the English River system. When water levels were raised on Lac Seul in the 1930's by construction of a dam at the outlet, thousands of acres of standing forest were flooded and killed. To-day many of these dead trees are still standing while others have broken off at various heights and lie in a tangled mass about the standing trees.

Manipulation of Water Levels

When waters are to be controlled by a dam the operating authorities are required to submit their estimate of the maximum and minimum water levels they will require. These operating levels must be approved by the Minister of Lands and Forests of Ontario.

Within the established limits water level manipulation depends on two factors, the amount of precipitation and the demand for power. The average regulated drawdown on the impoundments visited was approximately 10 feet with the greatest being 37 feet and the least several feet. In exceptionally dry years the full drawdown must be made while in normal years the drawdown may not be as severe.

The Effects of Impoundment and Water Level Manipulation on the Fish Population

This discussion must be necessarily general since no extensive pre and post impoundment studies of fish populations have been made in Ontario. Also the two effects: that of the initial impounding and that of water level manipulation are discussed together as they cannot be separated. The information that has been collected is in many cases an assessment of the angling in impounded waters. In a few cases commercial fishing data or preliminary biological studies were available.

The impoundment and manipulation of water can affect fish populations in various ways, chief of which are:

(a) Effect on migration.

(b) Effect on spawning.

(c) Effect on physical and chemical environment.

(d) Effect on biological food chain.

(a) Effect on Migration

The prevention of fish migration by hydro-electric dams is not a serious problem in Ontario. The majority of waters on which dams are located support mainly the warm water sport fish species such as northern pike (Esox lucius), yellow pickerel (Stizostedion vitreum) and smallmouth bass (Micropterus dolomieu) none of which migrate extensively to spawn. In many of our larger river systems more or less discrete populations of these fish live in various sections of the river separated from one another by dams or natural barriers. There evidently are suitable spawning grounds for these species in close proximity to their main habitat.

The rainbow trout (Salmo gairdneri) in the Great Lakes migrate into various streams to spawn but there are few hydro-electric dams located in positions to affect this migration.

(b) Effect on Spawning

The general procedure of holding water from the spring runoff and releasing it during the fall and winter does not appear to affect the spring spawning species to any extent. Although there are no specific biological data in this regard controlled waters provide angling of a quality comparable to non-controlled waters. The same situation appears to be true for the summer spawning bass.

The lowering of water levels during the fall and winter can seriously affect the fall spawning species, the most common of which are the lake trout (Salvelinus namaycush) and whitefish (Coregonus clupeaformis). The effect of drawdowns on lake trout reproduction has been studied by Martin (1955) for certain Algonquin Park Lakes. His studies emphasize the fact that each lake is a separate problem since levels fluctuate differently from lake to lake, and year to year in one lake, and also because lake trout spawn at different depths in various lakes. Mr. Martin found that egg loss through drawdown occurred in certain years but could not estimate the percentage of the total egg deposition that was lost. It is his belief (personal communication) based on further investigation of some 12 lakes in the Algonquin Park area that the small drawdowns which occur are not seriously harmful to lake trout reproduction.

Whitfield (1950) carried out some preliminary studies on lake trout spawning in Lake Wanapitei in Northern Ontario which fluctuates 7-10 feet on the average. From his knowledge of the depth of spawning beds he has estimated that the drawdowns over a ten-year period have resulted in an average of 26% loss of lake trout eggs.

In the smaller river systems like the Mississippi which drains several lakes and empties into the Ottawa River one lake may be chosen for storage and subjected to a severe drawdown. In this system three headwater lakes receive small drawdowns of several feet early in the fall. This water is stored in the fourth lake (Cross Lake) which receives a fourteen foot drawdown. This drawdown has eliminated the lake trout population from Cross Lake.

As with lake trout the effect of water level manipulation on whitefish reproduction depends on the depth at which they spawn and the amount of drawdown during the period the eggs are on the spawning beds. Lac Seul contains a sizeable whitefish population and its maximum and minimum water levels are 1172 and 1165 respectively. Only part of this seven feet fluctuation would occur when whitefish eggs are on the spawning beds. However, there is a proposal at the present time to establish the minimum level at 1156, an additional drawdown of nine feet. If this is approved it is highly probable that whitefish reproduction will be seriously reduced if not eliminated. Commercial fishermen operating on this lake are requesting the establishment of a whitefish hatchery if a larger drawdown is approved.

(c) Effect on Physical and Chemical Environment

There are little data on any changes that have occurred or may occur in Ontario impoundments with respect to water temperature, O_2 content, turbidity, silting, etc. However, it appears that on natural waters controlled by dams at the outlet that the effects on the fish population have been slight.

Where impoundments have been created by the construction of dams on rivers and streams they may acquire lake characteristics depending on the source of the impounded water, the manipulation of the dam and the depth of the impoundment. Some impoundments have an established thermocline while in others there is little temperature gradient from top to bottom.

An incident of fish mortality in the Ottawa River at the Otto Holden Dam may possibly demonstrate some of the factors involved in impoundment. This fish mortality was investigated by Millest and Irizawa (1955) who found that the impounded water ranged in temperature from 67°F at the bottom (75 ft. +) to 72°F at the surface. Dissolved oxygen content was a low 0.7 c.c. per litre at the bottom and 1.8 c.c. per litre at the surface. Their investigation revealed several factors which exerted coincidental influences to bring about this situation. The river was receiving pulp mill waste from upstream, the weather was extremely hot during that period and the flow of water through the dam was shut off for three days. The pulp mill wastes were thus completely impounded in very warm water for three days causing increased decomposition and the resulting depletion of dissolved oxygen. When the dam was opened the dead fish near the gates were swept through and the fish immediately downstream were exposed to warm water of low oxygen content and were killed.

In certain impoundments additional habitat has become available to the population of native fish with a resulting increase in this population. The creation of Rocky Island Lake in 1950 by damming the Mississagi River has resulted in an expanded pike population which has become very popular with anglers. The creation of Eugenia Pond by damming the Beaver River has provided additional habitat for the native speckled trout population and for the past forty years the production of trout from this impoundment has been greater than the original stream could support. Anglers on Lac Seul experience excellent success fishing around the flooded timbered shoreline of this lake.

(d) Effect on the Biological Food Chain

The effect of impoundment and manipulation of water levels on the populations of plankton, bottom fauna and forage fish species has not been studied. The fact that the predatory species, which are dependent on these organisms, are existing, apparently in sizeable numbers in the controlled waters suggests that they have not been affected too greatly.

Wildlife on Hydro-Electric Impoundments

The wildlife situation on hydro-electric impoundments is not too well understood and as with fisheries there are little specific data to indicate the status of these wildlife populations.

The majority of impoundments visited supported small populations of ducks but these are not considered of any major significance by local offices. These impoundments are also utilized as stop-overs by migrant waterfowl to a limited extent.

Similarly, the majority of impoundments support fur-bearing populations but the relationship of these populations to the manipulation of the water levels on the impoundment has not been studied to the writer's knowledge. It is commonly accepted, however, that drawdowns do affect muskrat populations. Fur production records on certain impoundments shed little light on the situation.

Recreational Aspects of Hydro-Electric Impoundments

There is little development for recreational purposes on most of the hydro-electric impoundments for several reasons:-

(a) Limited access to the impoundment.

(b) Sparse human population.

(c) Availability of other waters.

(d) Development on some impoundments is not encouraged.

Practically all existing development has angling and recreation as its origin. This development is in the form of tourist outfitting camps and private summer cottages. Although there are occasional local complaints concerning water level manipulation, in general there appears to be a minimum of conflict between hydro-electric authorities and recreational interests. On lake trout waters there is, of course, more conflict than on non-lake trout waters.

II FLOOD CONTROL IMPOUNDMENTS

The need for the control of water flow in various southern Ontario watersheds is the result of excessive conversion of forested areas to agricultural use and the drainage of swamps which had served as natural storage reservoirs.

This situation has given rise to two main problems. Firstly, the lack of natural storage reservoirs results in a rapid run-off which under certain meterological conditions reaches flood proportions and causes extensive damage. The loss of valuable top soil and siltation are associated with this condition. Secondly, the rapid run-off in the spring results in inadequate stream flows throughout the summer and winter. This stream flow is required for maintenance of the water table, for healthy fish populations, for drinking purposes, for the dilution of pollution, for the generation of power and for the natural scenic beauty associated with river systems.

The need for the control of water flow in southern Ontario gradually became apparent and in the 1930's various municipalities met with government representatives to determine the proper measures to achieve this control. These measures required a "watershed approach" and the integration of the municipalities within a watershed into a conservation authority.

The problem confronting a river valley conservation authority is to limit the probability of flooding in the spring and to retain sufficient water in storage to ensure adequate stream flow for all purposes.

There is a long term approach to this problem and it consists of replacing the proper amount of forest cover and restoring wetlands to their previous natural condition. This approach has several drawbacks. It is not an immediate remedy and a large scale reforestation program in southern Ontario would be very costly and difficult to implement. The restoration of certain wetlands would be similarly difficult to achieve.

A more immediate approach and a much easier one administratively is to construct artificial reservoirs or impoundments to store spring run-off for controlled release during the summer and winter.

It appears that various river valley authorities have placed the emphasis on the immediate approach and have supplemented this with a limited reforestation program designed to reduce erosion and siltation.

Planning of Water Storage

The planning of artificial water storage within a watershed involves many considerations chief of which are:

(a) The amount of water available for storage depends on the annual rainfall and snowfall. Although much of this water may be lost through evaporation, transpiration and deep seepage records for southern Ontario indicate that in most years there is more than adequate water for our needs.

(b) The amount of storage required to reduce floods is based on records of the occurrence and intensity of past floods. This storage is calculated to eliminate the minor floods which occur most often and to control to a certain extent the major floods that may be expected at far greater intervals.

(c) The amount of storage required for other uses (which have been mentioned previously) depends on population size and development in the watershed and the value that we assign to these uses. The water retained to reduce flooding can of course, be used for these purposes.

(d) The cost of artificial water storage has a direct bearing on all planning. The cost is dependent on the amount of storage required, the geology and topography of the watershed and land values within the watershed. This cost must be compared with the benefits of water storage.

It is in this cost/benefit analysis that recreation and fish and wildlife aspects often receive minor consideration. This is due to the difficulty of placing a monetary value on the benefits accruing from hunting, fishing and outdoors recreation.

Discussion

To the writer, the crux of the matter is this:-

Through past use and misuse of land and water we have lost considerable fish and wildlife habitat and the recreational benefit associated with it. To regain this we require water storage over and above that required for other uses. We must be prepared to pay for this additional water storage and the integrated biological and engineering knowledge necessary to obtain full benefit from it.

Adjacent land should also be acquired with this water storage and developed with foresight and planning.

The previous paragraphs have dealt mainly with the artificial restoration or replacement aspects of river valley conservation development. It should be apparent however, that steps should be taken to restore and/or maintain the proper propagation of forest cover on various southern Ontario watersheds. The overall value of retaining natural swamps and wetlands (especially those at higher elevation) should also be apparent.

Summary

The most striking characteristic of Ontario impoundments is the lack of specific biological information with which to assess the relationship of fish and wildlife populations to the impoundment. Another characteristic is that although certain generalizations may be made on impoundments each is sufficiently different from the other to make specific recommendations somewhat hazardous.

The majority of hydro-electric impoundments are located on water systems inhabited by warm water species of fish. The angling activity on these impoundments may be classed as very light to moderate and angling success is comparable to that of non-controlled waters. Warm water fish populations appear to adjust adequately to water impoundment and in certain cases these populations have increased.

Where hydro-electric dams are located on the smaller watersheds containing fall spawning lake trout the effect of these dams on reproduction depends on the extent of drawdown and the depth at which this species spawns. Martin has investigated this situation in a number of Algonquin Park lakes and has demonstrated that loss of lake trout eggs may occur under certain conditions. He emphasizes that each lake is a separate situation but feels that the effect on the present fishery in lakes with small or moderate drawdowns is slight.

The location in more densely populated southern Ontario of impoundments for water control gives the fish, wildlife and especially recreational aspects of these impoundments greater significance. The dominant consideration here is their potential. This potential can be realized by giving proper consideration to fish and wildlife in planning water storage and manipulation; by increased biological study and by planned development of the land adjacent to the impoundment for recreational and other uses.

Some Considerations

In assessing and forecasting the future status of impoundments in Ontario two considerations should be kept in mind. These are the increasing importance of recreation and the approaching era of atomic power.

The prosperity of our country, the high standard of living, the shorter work week, paid vacations and improved means of transportation have placed a new and much higher value on recreation. A good portion of this recreation is being sought in the outdoors. The accelerated tempo of modern living makes outdoor recreation a necessity and a factor to consider in respect to the nation's health.

Ontario is fortunate in its abundance of waters but it should be remembered that its population is increasing steadily. This abundance of water will become more desirable recreation-wise and more accessible to a large population outside of Ontario as well. It would not be wise to dismiss the fish and wildlife values of any of these waters because they are not being realized at the present time.

It appears also that we are on the threshold of wide scale use of atomic power and other energy sources which will alter the status of hydro-electric power in our future economy.

Conclusion and Recommendations

There are various reasons for the paucity of factual information in the fish and wildlife aspects of impoundments in Ontario. In some districts no problems have been evident. In others the work load is such that an impoundment study would necessarily be a very cursory investigation. The transfer of personnel among districts has probably disrupted some studies. Perhaps the most important reason is the belief that an investigation would lead to naught.

It would appear that within the Department there is no integrated approach to the impoundment situation. One belief is that if a water system is required for (say) hydro-electric power other purposes may be disregarded. The multi-purpose concept is upheld by others.

It is recommended that the multi-purpose concept be adopted or reaffirmed as policy and that the divisions responsible for land, water and fish and wildlife maintain an integrated approach to the uses of impoundments.

It is recommended that closer liaison be maintained between the Department and the agencies or authorities which operate dams. This liaison should ease administrative difficulties in settling conflicts and lead to a more comprehensive understanding of impoundment problems by all concerned.

It is recommended that problems relating to impoundments be given priority in the work schedule of the districts, especially for impoundments in the early planning stage. Natural populations of fish and wildlife maintain themselves with little help but where habitat is being altered, as may be the case in impoundments, it is definitely worthwhile assessing the situation.

It is recommended that all districts be instructed to regularly obtain water level records from the operating authorities of dams and that these levels be plotted and analysed. Certain districts are doing this at the present time.

The development and/or preservation of marsh areas for wildlife is currently under study by many conservation agencies throughout the continent. These studies should be reviewed by a biologist experienced in this particular field.

It would appear to the writer that wetlands presently in the Crown should be retained and that arrangements be made for the acquisition or control of wetlands in the more densely populated areas which are not at present in the Crown.

It is recommended that the impoundment clearing experiment at the Caribou Falls hydro project in the English River be kept under observation. This area possesses a high potential for future recreational development and the results of this experiment will have a bearing on this development.

It is recommended that a biologist be employed to work specifically in problems related to hydro-electric impoundments. This biologist would keep abreast of impoundment studies, maintain liaison with hydro-electric interests and provide information and assistance to the districts.

With respect to river valley development two needs are apparent. First of all it is necessary to build a case for fish, wildlife and recreational development to obtain funds for the additional water storage required. Secondly it is necessary to employ a biologist thoroughly experienced in all phases of river valley conservation development or if this is not possible to train one as quickly as possible. It would be this person's responsibility to carry out the preliminary biological surveys alongside the engineering surveys and to understand the engineering aspects thoroughly in order that biological and engineering data may be integrated into a suitable plan. The assistance this person would require would be based on the scale of the development and the funds provided for fish, wildlife and recreational development.

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PARRY SOUND LAKE TROUT SPORT FISHERY - 1959

by
A. Dube' and C. A. Rettie

Abstract

A survey was conducted to gather information on the lake trout sports fishery and sea lamprey attacks on lake trout in the Parry Sound area. From creel census forms distributed to tourist camp operators and local anglers it was learned that of 280 lake trout captured from June 11 to October 8, 1959, 158 had lamprey scars. The average number of lamprey scars per scarred fish was 1.7 and two fish had 10 scars each. The average length of lake trout captured was 24.3" (277 fish) with an average weight of 6.6 lbs. Six fish weighed 18 lbs. or over and the largest recorded was 36 3/4" in total length and weighed 23 lbs.

The lake trout fishery of Georgian Bay has reached a very low ebb because of the depredations of the sea lamprey. Parry Sound or "The Big Sound" is one of the last strong holds of this valuable species and still remains an area where anglers can pursue their sport with reasonable hope of success. Again this year an effort was made to gather information concerning lamprey attacks on the trout.

In early June, we contacted all tourist camp operators and many local anglers who were known to fish in this area and enlisted their aid. Creel census forms were distributed and the information requested for each lake trout was:

1. Date caught.
2. Total length.
3. Weight in pounds and ounces.
4. Number of lamprey scars.
5. Location where caught.

Envelopes were also supplied so that scale samples could be obtained for each fish.

The response to this appeal for information has been excellent and I would like to take this opportunity to thank all those who co-operated.

The data obtained are being forwarded to South Bay Research Station where they will be studied, age classes determined from the scale samples and a detailed report written. The following summary has been prepared for your immediate information.

Number of private anglers contributing information	6
Number of tourist camps contributing information	6
Total lake trout captured June 11 - October 8	280
Average length of lake trout based on measurements of 277 fish	24.3"
Average weight of lake trout based on weights of 279 fish	6.6 lbs.
Total number of lake trout with lamprey scars	158
Total number of lamprey scars on lake trout	268
Total number of scale samples obtained	271

Of these 280 captured lake trout, 36 were taken in June, 141 in July, 69 in August, 31 in September and three in October. This, I believe, does not indicate when the fishing success was better but rather when the fishing pressure was the greatest.

Six fish weighed 18 lbs. or over. The largest recorded was 36 3/4 inches in total length and weighed 23 lbs. This fish was captured on August 11th. The smallest trout recorded was one measuring 15 1/2 inches and weighing 1 1/4 lb.

Although the average number of lamprey scars per scarred fish is 1.7 there were two fish recorded as having 10 scars each.

Two lake trout that had been previously tagged in the fall of 1958 were recaptured.

Although this project has been carried out for two years, more data will be required in the future for our fisheries management program. We hope we can count on the continued support of the anglers and tourist outfitters.

HILL'S LAKE HATCHERY EXPERIMENT NO. 8 ON AERIAL FISH PLANTING, 1959

by
N. D. Patrick

Abstract

In order to test the merits of plastic containers for transporting live fish, extensive experimental work was carried out during the summer of 1959 in Swastika District. Experiments were designed to test various methods of holding fish and to ascertain what happened to fish after they were dropped from aircraft. Tables are presented showing the results of tests on: the carrying capacity for plastic bags with oxygen and M.S. 222; the effect of periodic agitation; the carrying capacity using a buffer; and the shipping capacity and times using plastic bags, anaesthetic and buffer. The study found:

1. The use of chemicals and plastic bags for transporting fish have great potential.

2. Fish dropped generally went to the bottom of the pond and remained motionless for varying lengths of time.

3. The use of plastic bags with a buffer, anaesthetic, oxygen and water is the best method of carrying fish over considerable distances manually that has been used to date.

4. A planting of 2,314 Aurora Trout made into one pack-sack of plastic bags weighing 50 lbs. was carried over a mile portage. Only two fish died as a result of handling injuries and the rest were observed to recover and start feeding after planting.

During recent years, a number of agencies have been experimenting with the use of plastic containers for transporting live fish. Reports of these experiments indicate that this method has considerable potential and may well prove to be an improvement on methods presently being used at Hill's Lake Hatchery in Swastika District. For this reason, the following experimental work was carried out during the summer of 1959.

Objective

The objective is threefold: (a) to familiarize personnel with the method, and stimulate progressive thought among the hatchery staff; (b) to investigate the possibilities of modifying the plastic

bag transportation technique so that it may be adjusted to suit either or both aerial and truck plantings, and (c) to investigate the use of chemicals in fish transportation.

Acknowledgments

This work was most certainly a co-operative effort, and the assistance of the following personnel is gratefully acknowledged: The staff at Hill's Lake Hatchery, particularly Mr. P. Graf, Ass't. Sr. Conservation Officer R. Johanson, skin divers J. Royal and D. Ramsay of the Northern Aquatic Group, and Mr. J. P. Currier of the Canadian Wildlife Service, all contributed to the project.

Method

Two separate phases of experimentation were involved as follows:

(a) The Method of Holding the Fish in Bags

Different numbers of fingerling, yearling and two-year old speckled trout were held for varying lengths of time in plastic bags using several combination of water, anaesthetic, buffer and oxygen. After the first trial, it appeared that agitation of the bags at intervals was a factor, and hence, a series was run with one set of bags being agitated at one-half hour intervals. The first trial also demonstrated the importance of starving the fish prior to the experiments.

In each case, fish were hand counted, weighed, anaesthetized and then placed in measured amounts of solution in plastic bags. Oxygen was added and the bags were tied off with heavy rubber bands and then placed in the water in the spillways to maintain them at a constant temperature.

Bags were made of two sizes from tubing supplied by Mr. J. P. Currier of the Canadian Wildlife Service. Small bags were made from three mil six inch tubing, and large ones from four mil ten inch tubing.

(b) Aerial Plantings

After the first phase experiments were completed, the method was used for an aircraft drop in two stages. Six lots of 200 yearling speckled trout were prepared and placed in six inch size plastic bags containing one gallon of mixture (six gals. water, two gm. buffer and 1/2 gm. M.S. 222) and filled to capacity with oxygen. The bags were about 3/5 full of fish and solution, and 2/5 full of oxygen. One bag of fish was retained in a trough at the hatchery as one control, two bags were dropped from the aircraft into an empty pond at the hatchery (shallow water), two bags were dropped into a pre-arranged target area in Lawgraves Lake (40' deep), and the last bag was retained in the aircraft as a second control. Two skin divers were on hand at Lawgraves Lake to observe the drop from below surface and to follow the recovery of the fish.

Observations

(a) The Method of Holding Fish

Three separate tests were made using the plastic bags, and the results of these are tabulated as follows:

TABLE I - "Carrying Capacity for Plastic Bags With Oxygen and M.S. 222"

This was in effect a trial run, and it was immediately obvious that the fish should have been starved beforehand. Metabolic products very rapidly made the water solution milky. During this test, it appeared that fish soon suffered in some parts of the bags unless the bags were agitated.

TABLE II - "Effect of Periodic Agitation"

This second run was prepared with two duplicate series of fish, and series "B" was agitated by hand every half hour. It is obvious that agitation reduced losses in all but the last lot (lot 4) and this lot may well have been loaded with fish beyond the point where agitation was effective.

TABLE III - "Carrying Capacity Using Buffer"

A quantity of trias buffer was supplied by Mr. Currier and its effectiveness tested at a concentration of two gms. in six gals. of water. Comparison of this table with Table II demonstrates the effectiveness of the buffer.

TABLE IV - "Shipping Capacity and Times Using Plastic Bags, Anaesthetic and Buffer"

This table was prepared based on the results of Table III. It is not to be considered as a final standard for use, but was prepared to demonstrate that the plastic bag method compares favourably with the aircraft dropping equipment now used. Normally a Beaver aircraft carries a full load of 9,000 yearlings, and in plastic bags, this could be done for short trips (three hours or less) with a total weight of less than 850 lbs. (Maximum beaver payload is 850 lbs.)

(b) Aerial Planting

The aerial drops were carried out on the morning of September 5th, 1959, and observations were recorded as follows:

Preparation

Fish were counted and prepared between 10 and 10:30 a.m., so that by 10:30, six lots of 200 yearling speckled trout had been anaesthetized in a solution of one gm. M.S. 222 in eight gals. of water and then placed in plastic bags containing a gallon of the following solution - six gals. water, two gms. buffer and 0.5 gms. M.S. 222. The bags were filled with oxygen.

TABLE I - Carrying Capacity for Plastic Bags With Oxygen and M.S. 222

Note: "A" Series with O_2 only.
"B" Series with O_2 plus M.S. 222 - 1.0 gm./8 gal. H_2O.

Tube Size and Lot Number	Amount Water	Fish Age	No. of Fish	Weight of Fish	Temp. F.	Time Started	Time Finished	Total Loss	Longest Holding Time
Large - 1A	2 Gal.	2 Y.	50	9 lbs.	50°	3:00 p.m.	5:30 p.m.	14	1.75 Hr.
Large - 1B	2 Gal.	2 Y.	50	8 lbs.	49°	10:30 a.m.	2:00 p.m.	0	3.5 Hr.
Large - 2A	2 Gal.	2 Y.	75	11.5 lbs.	50°	3:45 p.m.	5:00 p.m.	15	1.0 Hr.
Large - 2B	2 Gal.	2 Y.	75	10.5 lbs.	48°	10:45 a.m.	1:15 a.m.	25	Unknown
Large - 3A	2 Gal.	2 Y.	25	4 lbs.	50°	3:50 p.m.	12:00 night	2	5.0 Hr.
Large - 3B	2 Gal.	2 Y.	25	3.5 lbs.	48°	10:50 a.m.	11:30 p.m.	1	12 Hr.
Large - 4A	2 Gal.	Y.	195	5 lbs.	50°	4:00 p.m.	5:30 p.m.	16	0.75 Hr.
Large - 4B	2 Gal.	Y.	191	5 lbs.	48°	11:00 a.m.	1:45 p.m.	50	Unknown
Large - 5A	2 Gal.	Y.	405	10 lbs.	50°	4:10 p.m.	5:00 p.m.	28	0.5 Hr.
Large - 5B	2 Gal.	Y.	381	10 lbs.	48°	11:05 a.m.	1:15 p.m.	224	Unknown
Small - 6A	6 lbs.	Fg.	500	890 gm.	50°	4:20 p.m.	9:10 p.m.	19	3^+ Hr.
Small - 6B	6 lbs.	Fg.	500	882 gm.	49°	11:15 a.m.	5:15 p.m.	109	4 Hr.
Small - 7A	7 lbs.	Fg.	250	370 gm.	50°	4:30 p.m.	12:00 night	1	7.5 Hr.
Small - 7B	7 lbs.	Fg.	250	365 gm.	49°	11:30 a.m.	6:45 p.m.	3	7.0 Hr.

TABLE II - Effect of Periodic Agitation

Note: (1) "A" Series not disturbed during experiment.

(2) "B" Series agitated at 1/2 hour intervals. Both series in solution of 1 gm. M.S. 222/8 gals. H_2O with O_2.

(3) Water temperatures maintained between 47° and 52° F.

Lot Number	Number and Age of Fish	Weight of Fish	Amount Water Solution	Duration of Expt.	Loss
1 A	200 Y.	5.8 lbs.	2 gal.	2 Hrs.	119
1 B	200 Y.	5.8 lbs.	2 gal.	2 Hrs.	97
2 A	100 Y.	3.9 lbs.	2 gal.	2 Hrs.	61
2 B	100 Y.	2.5 lbs.	2 gal.	2 Hrs.	0
3 A	300 Fg.	500 gm.*	6 pint	3 Hrs.	78
3 B	300 Fg.	500 gm.*	6 pint	3 Hrs.	23
4 A	400 Fg.	668 gm.*	6 pint	3 Hrs.	148
4 B	400 Fg.	668 gm.*	6 pint	3 Hrs.	149

* Figures based on average weights and not actual weights.

TABLE III - Carrying Capacity Using Buffer

Note: Series Solution - 1/4 gm. M.S. 222, 2 gm. Trias Buffer/6 gals. water.

Bags agitated at 1/2 hour intervals.

Fish anaesthetized in 2 gm. M.S. 222/ 6 gals. water.

Water temperature maintained between 48° and 54° F.

Lot Number	Number and Age of Fish	Weight of Fish	Amount of Solution	Duration of Expt.	Loss	Longest Period Fish O.K.	Remarks
1	100 Y.	3.6 lbs.	1 gal.	12.25 Hrs.	1	12+ Hrs.	
2	200 Y.	7.2 lbs.	1 gal.	7.0 Hrs.	43	5-6 Hrs.	
3	300 Y.	11.0 lbs.	1 gal.	4.0 Hrs.	166	3 Hrs.	
4	400 Y.	15.0 lbs.	1 gal.	4.0 Hrs.	344	3 Hrs.	Note (1)
5	200 Fg.	330 gms.	½ gal.	8.0 Hrs.	0	8+ Hrs.	Note (2)
6	300 Fg.	490 gms.	½ gal.	7.5 Hrs.	1	8 Hrs.	
7	400 Fg.	740 gms.	½ gal.	7.75 Hrs.	13	7 Hrs.	
8	500 Fg.	920 gms.	½ gal.	7.0 Hrs.	201	5-6 Hrs.	

(1) At three hours fish were suffering, but no mortality observed.

(2) Bag developed a leak after 1/2 hour and oxygen escaped.

TABLE IV - Shipping Capacity and Times Using Plastic Bags, Water, Anaesthetic, Buffer and Oxygen, at Water Temperature 47° - 55° F.

	Yearling In One Gallon Solution				Fingerlings In 1/2 Gallon Solution			
	100	200	300	400	200	300	400	500
Maxiumu Holding Time	12^+ Hrs.	5 Hrs.	3 Hrs.	3 Hrs.	8^+ Hrs.	8 Hrs.	7 Hrs.	5 Hrs.
Fish/100 Lbs. Shipping Weight	750	1100	1300	1600	3600	5100	6000	7350

Note: Shipping weights do not include weight of ice or larger containers.

Bag #1 was placed in a hatchery trough in water at 40° F. and checked periodically. This bag was emptied at 12:30 noon and all fish recovered in good condition.

Bags #'s 2, 3, 4, 5 and 6, and two bags of ice were placed aboard aircraft O.C.D. with pilot Dean Allen and Conservation Officer D. Perry at 11:00 a.m. and the aerial drops commenced. The weather was warm, sunny and clear with a light south breeze gusting up to 10 m.p.h., becoming more gusty by noon.

Hatchery Drop

Pond #3 at Hill's Lake had been cleaned and filled prior to the experiment. Two separate drops were made at approximately 11:20 a.m. from the aircraft at 90 m.p.h. from an altitude of 200 feet. Drop #1 almost completely missed the pond, and Drop #2 fell mostly in a neighbouring pond. The aircraft cabin temperature was 80° F., the water temperature in the bags 48° F. and the pond temperature was 42° F.

At least 37 fish from Drop #1 landed in Pond #3 and were observed as they recovered. Two fish failed to recover, but they were close to the cement spillway and were assumed to have bounced from the spillway into the water. All the fish landing in the pond sank to the bottom (about three feet), and most of them lay motionless, right side up. Six fish were lying on their sides on the bottom immediately after the drop. All fish except the two mentioned above showed normal slow respiratory movements. After about 30 minutes, most of the fish started to recover and move around. First recovery was usually accompanied by sporadic attempts to surface.

Drop #2 landed mostly in Pond #2, containing legal sized two-year old fish. Immediate observations were the same as for Drop #1, but recovery observations were terminated as a result of cannibalism. As soon as the motionless fish started to recover, they were attacked by the larger fish.

Lawgraves Lake Drop

The crew, consisting of skin divers J. Royal and D. Ramsay of the Northern Aquatic Group, accompanied by Ass't. Sr. Conservation Officer R. Johanson, were on Lawgraves Lake with all in readiness by 11:00 a.m. A triangular target area had been marked out with buoys.

Two drops of 200 fish each were made, one at 11:50 a.m. and the second at 11:55 a.m. Fish were dropped from an altitude of 200 feet at 90 m.p.h. Cabin temperature was 80° F. and bag temperature was 46° F. The air temperature was 66° F., and the water temperatures were as follows:

Surface - 68°
5' - 66°
10' - 66°
15' - 66°
20' - 66°
25' - 66°
30' - 62°
35' - 52°
46' - 44°

At the time of Drop #1, diver Royal was under water in the center of the target area and diver Ramsay was in the boat with Johanson. The first drop landed at the Northern edge of the target area, and after Royal was summoned to surface, Ramsay was taken to the location of the drop and went under. The second drop landed in the same place as the first, over Ramsay who was about 20' under the surface. Both divers submerged and made observations. The following observations are taken from Mr. Johanson's report:

"Mr. Royal was the first diver to return to surface at 12:10 p.m. He reported seeing approximately 30 fish laying on bottom of lake, and he observed two of these regain mobility. They swam up out of the cold water into warmer water."

"Royal returned to bottom of the lake and re-surfaced at 12:15 p.m. with three speckled trout, picked up from the bottom. These fish were activated in the water by Johanson - two swam away normally and the third would swim a short distance and roll over on its side, and then swim again." "The under part of this third fish appeared blood-shot, and probably it had hit the surface of the water too hard when dropped from the aircraft."

"Mr. Royal reported seeing five speckled trout in good condition swimming around in about a 10' depth of water. He did not go under water after returning to surface at 12:15 p.m. as his oxygen tank was exhausted."

"D. Ramsay returned to surface at 12:15 p.m., and reported being in about 20' of water at the time the second drop was made over him. He could not see the fish hit the water as the sun was too bright, but he could hear the fish when they hit the water, making a sound similar to heavy rain falling on a roof. Right after the drop, Ramsay saw some fish swimming around which appeared in good condition. Others were swimming in a circle appearing as if they were dizzy, and some were slowly sinking to the bottom. He estimated about 50 speckled trout were seen on the bottom of the lake which appeared to be lifeless. Ramsay saw two speckled trout with half of their tails gone, but this did not appear to affect their swimming. He also saw two speckled trout with the dorsal fin missing swimming without any difficulty." (Note: These are hatchery deformities.)

"Ramsay returned to bottom of the lake at 12:20 p.m. and re-surfaced at 12:25 p.m. He brought up four speckled trout from the bottom which appeared very dead - mouth wide open, gills extended and body arched. He observed a few speckled trout on the bottom, from the second drop, make a few movements and sink into the soft ooze on the bottom, and he did not think these fish revived."

"Johanson observed six speckled trout swimming around without any ill effects in about a 2' depth of water, approximately two to three minutes after the second drop."

"The divers reported the water extremely cold below 30' - 35' depth. They could see the cold area before entering it. It looked like a thin layer of fog."

Mr. Perry, aboard the aircraft, reported the fish all left the aircraft in good condition, with the exception of two in the last bag dropped which were presumed dead. The sixth and final bag was returned to Swastika at about 12:20 p.m. and stored in the cooling compartment of the freezer. By the time the Lawgraves drops were made, Mr. Perry reports that many of the fish had recovered from the anaesthetic and were swimming actively inside the bags.

The fish in the sixth bag were retained until 3:00 p.m., at which time there were only 40 survivors. Periodic agitation would probably have prevented much of this loss.

Conclusions

It must be pointed out clearly that this experiment was of a preliminary nature. In this respect, it served its purpose well, and there is little doubt in the writer's mind that the use of chemicals and plastic bags for transporting fish have great potential. Much more careful preliminary work is required and this experiment serves to justify proceeding in this direction.

Aerial planting of fish requires more investigation Results of the hatchery drop confirmed observations made in Experiment #6, viz., dropped fish generally went to the bottom of the pond and remained motionless for varying lengths of time. Observations at Lawgraves Lake fail to demonstrate clearly what happens when fish are dropped into deep water, but some did go to the bottom and sink into the soft bottom ooze. We have one confirmed report of a complete failure of an aircraft planting, and have records of a number of unexplained unsuccessful plantings. Success of planting is a large consideration in rating waters as suitable for speckled trout in our present management plans, and if this is done, the planting method must be one that has been proven or at least investigated thoroughly under all conditions.

The use of plastic bags with a buffer, anaesthetic, and oxygen, as well as water is the best method of carrying fish over considerable distances manually that has been used by the staff in this District to date. A planting of 2,314 Aurora Trout fingerlings was made on September 16th, 1959, and the entire planting was made into one pack-sack of plastic bags and carried over a one mile portage. The entire pack including ice did not weigh over 50 lbs. Two fish died as a result of handling injuries and the rest were observed to recover and start to feed after planting.

The following experimental work is recommended as a follow-up to refine the methods of utilizing these transporting techniques.

(1) A complete series of tests to determine the quantities of buffer required to stabilize the pH of Hill's Lake water with varying lots of fish for varying lengths of time.

(2) A series of tests to determine the usefulness and cost of chemically treating water in truck tanks to increase the carrying capacity of the truck. This should be of particular use in transferring large numbers of fish from one hatchery to another.

(3) An investigation of methods of efficiently packaging fish in plastic bags. This is a cumbersome affair at present, but can no doubt be very much improved.

(4) An extensive series of underwater observations of air-dropped fish under various conditions of water temperature, depth and using both normal and anaesthetized fish.

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